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This Coat Kills Reflections

Some of Its Many Potential Uses in Photography As Well As in Other Fields Are Told

LIGHT IS THE EXTERNAL AGENT that stimulates the retina of the eye and makes things visible.

In a way, the eye in action is very like a camera. It has a lens behind the iris, which forms an image on a sensitive surface, the retina. Unlike film, however, the retina is not permanently changed when light falls upon it; it merely acts as a medium to transmit the sensation to the brain.

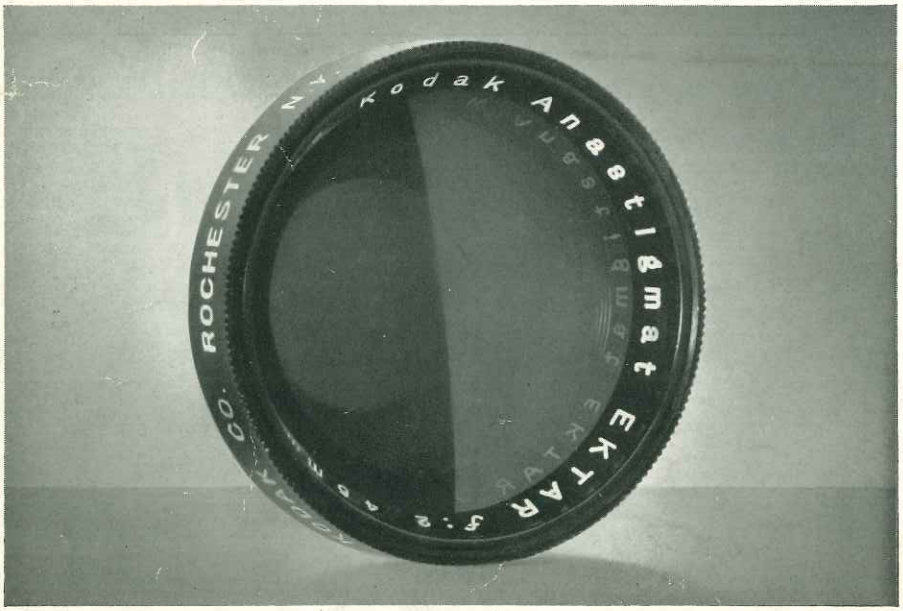
If, while you are reading these words, another person could look at the retina of your eye, he would see that an image of the page is formed on it, and that this image is inverted like all lens images. Your brain, however, considers this image right-side up.

If you're reading by daylight, the light that falls on your retina comes originally from the sun and is reflected by this page, enabling you to see it. In the same way, the chair on which you are seated, the table, the trees outside your window—all the objects in the world about you—reflect light and, hence, are visible.

Some materials—glass, for instance, or Kodapak, or film—are such that the greater part of the light passes through them. These are said to be "transparent," but this does not mean that they transmit all of the light. They reflect some of the light rays that fall upon them—otherwise, we would not be able to see them. (Think of the trouble one would have carrying an invisible sheet of glass down a crowded street.)

Each surface of ordinary glass reflects 4 per cent, or more, of the light that strikes it. You've seen "invisible glass" windows in stores, but these are panes so curved that reflections which normally would come to the eye are absorbed by black cloth below the window, giving us the illusion that there is no glass between us and the objects in the window. Think of the possibilities of glass made "invisible" without resort to curves or light-absorbing cloths. Eliminate the reflections and you've got it.

That's just what some clever physicists have done, by depositing on the glass a coating which, at a certain thickness, kills all reflection. The light which ordinary glass reflects is transmitted by the coated "invisible" glass. Perhaps 98 per cent of the light that strikes it passes through, whereas even the best ordinary glass will transmit only 92 per cent.



This is an unusual picture: it shows a lens surface, only the right half of which is reflecting light. The subject is the front components of the Ektar f/2, which has four air-glass surfaces. Of these, three have been completely coated to remove reflection, and one—the rear surface of the front element—has only its left half coated. Thus, there is reflection from the right half, but we can see through the left half

Why Not Lenses?

Why not increase the speed of lenses by means of this new process? Our research laboratories, among others, are now experimenting with this in view.

Because each surface reflects about 4 per cent of the light falling upon it, the loss of light increases rapidly with the number of surfaces used in the lens. The simplest lens consists of a single element, a glass disk with a curved surface.

Such lenses have small relative aperture. Larger lenses—that admit more light—are more complicated and they require more elements in order to focus the light waves accurately and get a good quality image. If, however, each air-to-glass surface in a lens reflects 4 per cent of the light, in a lens with 4 elements the total of light lost before the rays reach the film would be nearly 30 per cent. If we could get rid of this loss, it would be the equivalent of opening up the lens appreciably. Thus, an

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$f/6.3$ lens would be made faster than an $f/5.6$ lens.

In more complicated optical systems like the gastroscope or stomach viewing instrument, for instance, which employs as many as fifteen lenses that reflect about 71 per cent of the light, the nonreflecting coating would show still more remarkable results.

Reflections and "Ghosts"

Besides increasing the speed of a lens, the application of the new coating to lens surfaces would cut out annoying reflections—lens flare would be eliminated. Likewise, applied to the front surfaces of ordinary mirrors, which are rear-silvered, it would eliminate the "ghosts" that have been their main disadvantage. Many of us are familiar with instruments where front-surfaced mirrors are used: reflex cameras, one-shot color cameras, range finders, stereoscopic apparatus of various types, compensation mirrors in continuous projectors, and so on. Rear-silvered mirrors, treated with the nonreflecting coating, would give quite satisfactory results.

Other possible photographic uses of the nonreflecting coating include: application to the upper lens of a brilliant finder; to the smooth surface of a ground glass; to the cover glass of a copy holder; to projection-booth windows in theaters; to the windows of sound-camera blimps; to test tubes or other containers for biological specimens; to microscope cover glasses; to spectacle lenses (when photographing the wearer); and so on.

And general uses would include: the protecting glass for paintings in galleries and museums—no more waltzing around to get away from that "shine" that prevents your seeing the picture; on windshields, to keep from blinding "the other fellow" with reflected sunlight, and on automobile hoods, to keep from blinding yourself; on showcases and shop windows; on reflector buttons of highway signs, to prevent waste of light; on diamonds and similar jewels, especially opal type, to give them depth. . . . The possibilities are almost as boundless as the human imagination. But let's get back to our own field—photography:

When the nonreflecting coating process is available for application to the front surface of a glossy print, it will increase the contrast. Similarly, it will increase the color saturation of color prints. And if it is applied to film base—especially in the case of films that can't use antihalation backing, such as are exposed through the base—it will diminish halation.

Again, the process may be used to oust unwanted Newton's rings between two adjacent glass surfaces, or between a glass and a film surface, by making one surface nonreflecting. Such adjacent surfaces are common in the negative holders of enlargers.

One modification of the nonreflecting coating has been developed which reflects certain colors and transmits others, thus acting somewhat like a color filter. If it were made to reflect all infrared light and transmit all other light, it would act as a heat filter. Indeed, such coatings having suitable selective reflection and transmission of colors might well be used wherever filters are now employed.

In any photographic process such as the recording of sound on film or ordinary enlarging, it is possible to sidetrack some of the light for monitoring purposes, that is, to control the intensity. A combination filter and mirror such as we have described would make it possible to sidetrack only the light that is not the color required in the main process, and thus afford more efficient operation.

The Idea Isn't New

The idea of "invisible glass" is not new. Back in '92 H. Dennis Taylor, noted English optical engineer, discovered that certain tarnished photographic lenses transmitted more light than new ones and thus were faster. But although many subsequent workers investigated various coatings for cutting out reflections from glass, not until recently were serious efforts made to exploit this knowledge commercially. If this process proves as successful as results to date promise, it will be of real photographic value.

Step Right Up: It's the Kodak Precision Enlarger

Attracting much attention in the Eastman Kodak Building at the New York World's Fair is this display which affords revealing close-ups of, left to right, the Supermatic Shutter, the Kodak Precision Enlarger, and Kodak films and papers. This picture was taken at a "preview" staged in the Kodak Office auditorium